

and of the dew-point. The quantity of water evaporated in a unit of time from the muslin surface may be considered as depending essentially upon the wet-bulb temperature, the dew-point, and the wind.

The *relative humidity*, or the ratio between the moisture that is present in the air and the moisture that it would contain if saturated at its observed temperature is given in Table I as deduced from the 8 a. m. and 8 p. m. observations. The general average for a whole day, or any other interval, would properly be obtained from the data given by an evaporimeter, but may also be obtained, approximately, from frequent observations of the relative humidity.

#### PRECIPITATION.

[In inches and hundredths.]

No rain fell during the month over a considerable area in northern Mississippi, western Tennessee, and parts of the adjoining States of Kentucky, Alabama, Louisiana, and Arkansas. In all there were 18 States in which the measured rainfall at one or more stations was a trace or less.

The rainfall of September is heaviest on the average along the Gulf and Atlantic coasts and over the Peninsula of Florida. Smaller areas of comparatively heavy rainfall are to be found over the lower St. Lawrence Valley and the upper Lake Region, while a fourth area occasionally appears over or west of the Continental Divide in New Mexico and Arizona.

The rainfall of September along the Gulf Coast is subject to very great variations from year to year. The heavy fall on the coast line, moreover, does not, as a rule, extend far inland; thus, in 1879, while a total of 15 inches fell on the Texas Coast, there was barely an inch 150 miles inland in a northeasterly direction. The rainfall of September in the central interior valleys and the Lake Region comes almost wholly in the form of local showers and the distribution is consequently very irregular. Furthermore, there is almost without exception regions of deficient rainfall in the central and eastern portions of the United States whose magnitude and position vary with each successive year. During the last ten years the dry regions were located as follows:

1888.—In the Missouri and Mississippi valleys, portions of the Ohio Valley, Louisiana, and Arkansas.

1889.—In North Carolina, Georgia, Mississippi, Louisiana, Michigan, Minnesota, and Nebraska.

1890.—In the upper Missouri Valley and central Illinois.

1891.—Generally deficient rainfall throughout the Mississippi Valley, Tennessee, Georgia, Virginia, and West Virginia.

1892.—In the Mississippi and Missouri valleys.

1893.—In the upper Missouri Valley and lower Lake Region.

1894.—In the upper Missouri Valley.

1895.—Gulf States, Georgia, North Carolina, South Carolina, Virginia, West Virginia, Ohio, and Kentucky, a month of generally deficient rainfall.

1896.—Mississippi, Alabama, and portions of Georgia. Generally heavy elsewhere, except in the upper Missouri Valley.

While the rainfall of September, 1897, over almost the entire territory east of the one hundredth meridian was below the normal, the deficiency was most marked in the middle and lower Mississippi Valley, the Ohio Valley, the lower Lake Region, and the Middle Atlantic Coast, a region, it will be remembered, over which unusually heavy rains fell in March and April last. The central region of heavy rains in March last (see Chart III, March, 1897, REVIEW) is almost identical with the area of least rainfall, as shown on Chart III of this REVIEW.

During the sixty-one days that ended September 30 less than

50 per cent of the normal amount of rain fell in practically the whole of the Ohio basin and the greater portion of the Mississippi and Missouri basins. At St. Louis, Springfield, Mo., Indianapolis, and Cairo less than 25 per cent of the normal amount of rain fell during the period above mentioned.

While there has been general drought east of the Rocky Mountains, the rainfall of the eastern foothills and west of the Continental Divide in Colorado, New Mexico, and Arizona was heavier than usual. This is also true of Florida, the coast of Georgia, and portions of southern Alabama.

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III.

The *years of greatest and least precipitation* for September are given in the REVIEW for September, 1890. The precipitation for the current month was the greatest on record at: Jupiter, 18.09; Phoenix, 3.67. It was the least on record at: Nantucket, 1.31; Vineyard Haven, 0.80; Little Rock, 0.33; Corpus Christi, 0.98; Chattanooga, 0.07; Memphis, 0.00; Nashville, 0.19; Columbus, Ohio, 0.82; Parkersburg, 0.46; Buffalo, 0.31; Rochester, 0.46; Erie, 0.54; Springfield, Ill., 0.35; Hannibal, 0.30; Springfield, Mo., 0.37; Sioux City, 0.51; Oklahoma, 1.22. The above refers only to the stations included in Table I.

The *average departure* for each district is given in Table I. By dividing each current precipitation by its respective normal the following corresponding percentages are obtained (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: Florida Peninsula, 163; southern Plateau, 261; northern Plateau, 134.

Below the normal: New England, 62; middle Atlantic, 35; south Atlantic, 71; east Gulf, 57; west Gulf, 38; Ohio Valley and Tennessee, 24; lower Lake, 25; upper Lake, 48; North Dakota, 43; upper Mississippi, 36; Missouri Valley, 38; northern Slope, 39; middle Slope, 50; southern Slope, 78; middle Plateau, 40; north Pacific, 68; middle Pacific, 55; south Pacific, 0.

In Canada, Prof. R. F. Stupart says:

Over British Columbia and also over the eastern portion of the Maritime Provinces the rainfall was very nearly average, and in all other portions of the Dominion, except Saskatchewan and parts of Assiniboia, it was less than average, and generally to a very pronounced extent. In Manitoba it averaged but 0.3 inch; over most of Ontario it was only from 0.3 to 0.6, and the counties of Prince Edward and Hastings alone showed about 2 inches, an amount nearly approaching average. The deficiency was also very marked in the western portions of Nova Scotia and New Brunswick.

The *total accumulated monthly departures* from January 1 to the end of the current month are given in the second column of the following table; the third column gives the current accumulated precipitation expressed as a percentage of its normal value.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Inches.	Per ct.		Inches.	Per ct.
New England .....	+ 1.70	102	Middle Atlantic .....	- 4.60	87
Florida Peninsula .....	+ 9.40	123	South Atlantic .....	- 4.90	87
Southern Slope .....	+ 1.20	107	East Gulf .....	- 3.70	81
Southern Plateau .....	+ 4.30	164	West Gulf .....	- 8.90	73
Northern Plateau .....	+ 0.70	106	Ohio Valley and Tenn. ....	- 1.10	97
South Pacific .....	+ 0.70	109	Lower Lake .....	- 3.30	87
			Upper Lake .....	- 2.10	83
			North Dakota .....	- 0.70	96
			Upper Mississippi Valley ..	- 0.40	99
			Missouri Valley .....	- 2.80	89
			Northern Slope .....	- 1.60	87
			Middle Slope .....	- 0.20	99
			Middle Plateau .....	- 0.30	98
			North Pacific .....	- 2.70	83
			Middle Pacific .....	- 2.60	86

## SNOWFALL.

The *total monthly snowfall* at each station, if any occurs, is given in Tables I and II. The chart of geographical distribution is omitted for this month.

Light snow fell at a few points in Colorado and Wyoming on the 16th. Snow also fell at a few places in Montana on the 7th, 8th, 14th, and 15th; in Michigan at three stations on the 19th; in New York at one station on the 27th; at one station in Ohio on the 20th; in Utah at a few stations on the 23d, 28th, and 30th; in Idaho at one station on the 2d and 21st.

## HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 25. Arizona, 2, 9, 11, 23, 24, 25, 28, 29. California, 12, 25. Colorado, 11, 14, 16, 22, 25. Georgia, 1. Idaho, 3, 8, 11, 13, 28. Illinois, 1, 16. Indiana, 1, 16. Iowa, 1. Maine, 22. Michigan, 1. Missouri, 16. Montana, 8. Nebraska, 1, 5, 25. Nevada, 13, 25. New Jersey, 2, 13, 21. New Mexico, 15. New York, 26. North Carolina, 1. North Dakota, 6, 14. Ohio, 1, 16, 20. Oregon, 7. Pennsylvania, 13. South Dakota, 13. Utah, 10, 11. Washington, 7. Wisconsin, 19. Wyoming, 1, 26.

## SLEET.

Sleet was reported at Helena, Mont., on the 15th.

## WIND.

The *prevailing winds* for September, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

*Maximum wind velocities* are given in Table I, which also gives the altitudes of Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				Miles	
Charleston, S. C. ....	21	50	n.	Indianapolis, Ind. ....	1	50	w.
Cleveland, Ohio. ....	1	50	nw.	Do. ....	16	50	w.
Do. ....	10	50	nw.	Port Eads, La. ....	11	72	ne.
Hatteras, N. C. ....	3	50	nw.	Do. ....	12	50	ne.
Idaho Falls, Idaho. ....	13	50	sw.	Sandusky, Ohio. ....	16	53	nw.

The high velocities at Charleston and Port Eads occurred in connection with the passage of a West India hurricane; those at Cleveland, Sandusky, and Indianapolis were recorded during the prevalence of severe thunderstorms.

The winds were severe on Lake Erie on the afternoon of the 1st. Several small yachts were capsized; one life was lost, and a number of persons were in peril of their lives while the squall lasted.

The high velocity at Idaho Falls occurred with the shift of the wind from south to southwest about 2 p. m. of the 13th. The daily weather maps do not show pressure gradients over Idaho that would probably cause such a wind.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

## ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 1st, 167; 2d, 119; 13th, 123; 16th, 259.

Reports were most numerous from Arizona and Ohio, 88; Colorado, 108; Florida, 121.

Thunderstorm days were most numerous in: Arizona, 27; Colorado, 25; Florida, 26; Utah, 23.

*In Canada.*—Thunderstorms were reported on the following dates: St. Johns, 1; Grand Manan, 9; Bermuda, 14; Yarmouth, 10, 27; Charlottetown, 14; Chatham, 10; Father Point, 9, 13; Quebec, 5, 9, 13; Montreal, 10, 13, 26; Toronto, 13; White River, 5, 15; Port Stanley, 1, 12, 16; Saugeen, 26; Port Arthur, 5, 6, 7; Winnipeg, 8; Minnedosa, 14, 27; Medicine Hat, 8, 14; Swift Current, 1, 28, 29; Prince Albert, 2; Battleford, 28.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 6th to the 14th, inclusive. On the remaining twenty-one days of this month 38 reports were received, or an average of about 2 per day. The dates on which the number of reports of auroras for the whole country especially exceeded this average were: 1st, 4th, 11th, 4; 22d, 11.

Reports were most numerous from Illinois, 5; Montana, 6; North Dakota, 10.

The number of reports was a large percentage of the number of observers in: Delaware, 33; North Dakota, 17; Montana, 6.

*In Canada.*—Auroras were reported on the following dates: Father Point, 6, 15, 22, 23, 24; Quebec, 3, 4, 5, 11, 22, 28; White River, 23; Minnedosa, 2, 5, 10, 12, 19, 22, 23, 28, 29, 30; Qu'Appelle, 22; Medicine Hat, 6, 25; Banff, 9; Prince Albert, 10, 11; Battleford, 20, 22.

## SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic, and at 41 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table X for the 61 stations at which instrumental self-registers are maintained.